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ABSTRACT

Anaphora, a linguistic structure that refers to previously mentioned or implied text, has been implicated as a possible cause of reading comprehension difficulty among children. Reading research has focused on the surface structures of anaphora (pronouns and noun demonstratives, for example) and has viewed comprehension of anaphora as a language learner's systematic acquisition of these various structures. Such an analysis ignores the fact that anaphora reflects a complex relationship between an anaphoric structure and its antecedent. Research in cognitive science reveals that in comprehending anaphora, readers must bring a range of social, factual, and logical, as well as linguistic knowledge to the text. Linguistic analysis of anaphora indicates that it plays an important role in text comprehension by linking the various parts of the text. The study of anaphora promises to provide information concerning the structure of texts and the psychological processes involved in text comprehension. (Appendixes contain anaphora experiment materials and a summary of a cohesion and coding scheme.) (Author/PL)

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ANAPHORA: A CROSS DISCIPLINARY APPROACH
TO RESEARCH AND THEORY

by

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Report from the Project on
Studies in Language: Reading and Communication

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To my mother who shared with me the gift of reading.

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To my father who read our books.

And to Michael with whom I share an unending story.

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Chapter I

Introduction

Anaphora has been a topic of interest, not only in education circles, but also in the fields of linguistics, psychology, and cognitive science. The purpose of this technical report is to review relevant research and theory from these fields, both to provide a richer understanding of anaphora and to provide directions for future research concerning anaphora in reading comprehension.

Anaphora includes pronouns, pro-verbs, some definite noun phrases, and ellipses. An anaphoric item refers back to something that was previously mentioned in a text. The following examples contain three of the many anaphoric structures in the English language: personal pronouns, null anaphora (ellipsis), and "one" anaphora.

John had the ball. He threw the ball into the air.
He = John

Although the book had to be returned to the library,
Mary refused $\emptyset$.
 $\emptyset$ = to return the book to the library.

I have a '71 Ch. Figeas, a '76 Fleurie, a '71 Ockfener
Bockstein and a '75 Durkheimer Feuerberg in the cellar.
Shall we have the German ones for dinner tonight?
Ones = wines. (Webber, 1978, p. 24)

The review of the literature in this paper is selective, with the focus on research and theory which offer the greatest potential for understanding the role of anaphora in reading comprehension.

A review of the literature by Webber (1977a) was a significant step

toward bringing together information about anaphora from various disciplines. This paper is complementary to Webber's effort in that it reviews studies in educational research not mentioned by Webber and discusses research published since 1977.

The review of the literature is divided into three parts which correspond to Chapters 2, 3, and 4.

Chapter 2 reviews the developmental studies of comprehension of anaphora. In these studies, comprehension of anaphora is viewed as the systematic learning of the syntactic rules which govern anaphoric language.

Chapter 3 summarizes a "model-based view of comprehension" and discusses how the factors cited in the literature as influencing anaphor resolution can be understood within this framework.

Chapter 4 is a discussion of the role of anaphora as a "cohesive device" in text. Haliday and Hasan's (1976) method of analyzing the cohesive structure of text is presented and the results of work employing this method (Gutwinski, 1976) are discussed.

In Chapter 5, the significant contributions of each discipline (educational research, cognitive science, and linguistics) are summarized and the benefits of a cross disciplinary approach to anaphora are discussed. Specific questions for future research are outlined.

Chapter

Developmental Studies of Children's

Comprehension of Anaphora

Studies assessing children's ability to comprehend anaphora are few in number. To my knowledge there are only six such studies, all of which were conducted during the past 10 years. The six studies share the perspective that comprehension of anaphora depends upon the ability to correctly apply syntactic rules. The purpose of each of these studies was to discover developmental patterns in children's knowledge of these rules.

The Language Development Studies

Chomsky, 1969. Chomsky's landmark study, The acquisition of syntax in children from five to ten set the stage for subsequent studies concerning children's ability to comprehend anaphoric reference.

Chomsky's work was based upon the premise that syntactic structures that are in some sense at variance with generalizable patterns in the language are more difficult, and hence will be acquired late in language development. One such structure occurs in sentences which exhibit a co-reference restriction on pronouns. Chomsky's description of this phenomenon and her research assessing children's knowledge of the co-reference restriction are as follows:

Chomsky investigated children's interpretation of pronominal reference in the following structures:

Structure 1: pronoun is in main clause, precedes NP.
 Sample S, type 1: He found out that Mickey won the race.

Structure 2: pronoun is in subordinate clause, precedes NP.

Sample S, type 2: After he got the candy Mickey left.

Structure 3: pronoun is in subordinate clause, follows NP.

Sample S, type 3: Pluto thinks he knows everything.
 (p. 104)

Structure 1 is the only structure which blocks co-reference. In sentence 1 "he" must refer to someone else outside of the sentence. In structures 2 and 3 "he" can refer to either the occurring NP or to someone else. The choice would depend upon factors such as context or emphatic stress. Type 1 sentences are viewed as more complex because the restriction on co-reference applies in a limited number of sentence structures. Chomsky's hypothesis was that children would learn this restriction relatively late in language development.

Chomsky tested 40 children, ages 5 to 10, using an interview procedure. Children heard sentences of types 1, 2, and 3 and answered comprehension questions. For example:

Mickey told his mother he was hungry.
 Who was hungry? (p. 105)

Chomsky found that it was not until about 5.6 years that children demonstrate mastery of the rules governing co-reference.

The efficacy of Chomsky's method of investigating language development lies in her selection of questions for investigation.

Chomsky selected language development issues which have a clear, identifiable syntactic basis. In each study Chomsky specified the lexical item under consideration, the sentence constructions in which it occurs, and the syntactic rules governing its correct interpretation. Chomsky stresses the importance of isolating the syntactic component of language in studies of this nature:

In order to judge his knowledge of a syntactic structure it is necessary to present this structure in as neutral a context as possible. That is, we must remove semantic and situation cues which provide him with clues about the S's correct interpretation. In the absence of clues of this sort relating to factors other than structure, his interpretation will reflect his knowledge of the structure itself. (p. 23)

This method for investigating issues related to language development has limited applicability for studying the phenomenon of anaphora. At the heart of comprehension of anaphora is the ability to correctly identify the antecedent. The co-reference restriction limits the choice of the intended referent, but is not sufficient for its identification. For example, consider the following sentence:

He found out that Mickey won the race.
Who found out? (p. 103)

The correct answer to Chomsky's question is simply "someone other than Mickey." In a real reading or listening situation the child should be able to correctly resolve the anaphora to the intended referent. Chomsky's method is efficacious in isolating the syntactic component of anaphora. Correct resolution of anaphora,

however, forces one into the area where syntax and semantics interact--an area which cannot be investigated within either the theoretical or methodological framework developed by Chomsky.

Maratsos (1973). Maratsos isolated another interpretation rule which applies to pronominal reference in some situations. Maratsos tested children's ability to interpret sentences in which emphatic stress provides the cue to the intended referent of the pronoun. Maratsos offers the following sentences to demonstrate the effect of the stress pattern on pronoun interpretation:

1. John hit Harry, and then Sarah hit him. (p. 1)
him = Harry
2. John hit Harry, and then Sarah hit him. (p. 2)
him = John

One hundred and six subjects ages 3, 4, and 5 acted out sentence pairs such as the following using a set of small dolls consisting of a dog, a monkey, a boy, a girl, and an adult female.

1. Susie jumped over the old woman, and then Harry jumped over her. (pronoun = stressed object)
2. Susie bumped into the old woman, and then she bumped into Harry. (pronoun = unstressed object)
(p. 3)

Children's interpretation of unstressed pronouns is high and relatively stable across age groups. Response accuracy is .87, .83, and .93 for ages 3, 4, and 5, respectively. Results for stressed pronouns are quite different. Accuracy improves from .47 for 3-year-olds to .78 for 5-year-olds. When children are grouped

according to linguistic competency, as determined by an imitation task, the results are even more striking. Accuracy improves from .28 for the group with the lowest imitation scores to .81 in the top group.

Maratsos concludes that young children use a general cognitive strategy in which a sentence is interpreted so as to change the roles of participants as little as possible. Correct interpretation of stressed pronouns violates this natural strategy. As a result, correct comprehension of stressed pronouns lags behind unstressed, and improves with age and experience.

Chipman and de Dardel (1972). Chipman and de Dardel also focus on children's interpretation of pronominal reference. They investigate children's comprehension of the pronoun "it" in varying linguistic contexts. Chipman and de Dardel point out that:

When 'it' replaces a surface noun phrase, it can refer to a collective noun (milk, bread), or to a count noun (car, doll), or to nouns that can be either one or the other (chocolate, a chocolate). (p. 92)

In their study, 42 children ages 3.3 to 6.11 were presented materials which corresponded to the referent types associated with the pronoun "it" (collective noun, count noun, collective or count noun). The materials consisted of: a chunk of clay, a box containing 5 marbles, a box containing 20 marbles, an empty box, and bits of plasticine chocolate of varying sizes.

Children were given the following four instructions:

1. There is clay there. Give it to me.
Correct answer = all the clay
2. There is a box with 5 marbles. Give it to me.
Correct answer = box plus marbles
3. There are 20 marbles in the box. Give it to me.
Correct answer = box plus marbles
4. There is chocolate there. Give it to me.
Correct answer = all the chocolate

Success on all four tasks improves with age. The collective noun item (clay) is the easiest with 30% of the subjects responding correctly at age 3 to 90% at age 6. The two count noun instructions (box plus marbles) are next with instruction 2 (fewer marbles) easier than 3. Instruction 4, which includes the collective or count noun (chocolate), is least comprehended. Only two subjects, ages 5 and 6, responded by giving all the chocolate to the experimenter.

Chipman and de Dardel give the following description of the errors children made.

For the clay item, the main error consisted in the children giving a piece of the clay cake which they broke off. For the box of five marbles, the youngest children gave one marble; the children aged 4-5 gave several but not all marbles; and finally our eldest children (5-6 years) gave all the marbles from the box (but without the box). On the box of 20 marbles item, very few little children gave one marble only: most of them gave several but not all marbles, while our eldest children again gave all the marbles from the box (again without the box). For the chocolate item, the youngest children gave one little piece of chocolate. The children ages 4-5 years gave more than one little piece of chocolate, these being either several of the same type of piece (the smaller rectangles) or several of two different types (the smaller and the larger rectangles). Only

two of the 42 subjects ever gave all the chocolate.
(pp. 95-96)

The strongest conclusion that can be drawn is that children, even at the age of 3, have no problem understanding the referential nature of the pronoun. However, for the youngest children, "it" seems to mean a piece or one piece. Children's ability to understand reference to continuous quantities (e.g. all the clay, box plus marbles, all the chocolate) improves with age.

Chipman and de Dardel point out that comprehension of "it" may be influenced by cognitive development as well as linguistic development.

Furthermore, from studies in cognitive development it is known that children appear to handle small discontinuous collections with regard to concepts of quantity before they can handle either large discontinuous or small continuous quantities.
(p. 92)

Each of these three studies explores a different dimension of the anaphoric system. Chomsky addressed the role of syntax, Maratsos explored the influence of emphatic stress, and Chipman and de Dardel examined children's ability to deal with the range of antecedents which may correspond to a particular anaphor.

The variety of questions these researchers address indicates that anaphora is indeed a complex phenomenon. Their results, however, provide evidence that children, even at an early age, have developed some competence with regard to anaphoric language.

It is clear from all studies that an understanding of the

referential nature of pronouns is established very early, perhaps by age 3. Two rules relating to the interpretation of anaphora, the co-reference restriction (Chomsky, 1969) and the influence of emphatic stress (Maratsos, 1973), are established between the ages of 5 and 6. The 6-year-olds in the Chipman and de Dardel study demonstrated some awareness of the range of antecedents which may correspond to the pronoun "it."

The Reading Studies

The next three studies to be discussed concern anaphora and reading comprehension (Bormuth, Manning, Carr, & Pearson, 1970; Lesgold, 1974; Richek, 1977). The purpose of these studies was to investigate syntax as the basis of a learning hierarchy of anaphoric structures.

The belief that anaphora contributes to difficulty in reading has its roots in readability research. Syntactic complexity is one factor thought to contribute to the difficulty of a passage. Readability formulae do not measure this complexity directly, but use sentence length, number of prepositional phrases, or number of subordinate clauses as an index of syntactic complexity. In recent years, however, research has been directed toward investigating the influence of specific syntactic structures on comprehension (Bormuth et al., 1970; Pearson, 1974). One such structure under investigation is anaphora.

Not only is anaphora considered a candidate for introducing

complexity, and thus difficulty, in text, but because anaphora is a term which covers a wide range of structures, it was believed that a hierarchy of learning might also exist among different types of anaphora. Although this research may sound reminiscent of Chomsky's (1969) developmental language studies, there are fundamental differences in the definition of "syntactic structure" and hence in the basis of the learning hierarchy.

As you will recall, Chomsky tested children's comprehension of particular lexical items in varying linguistic contexts. For example, she tested children's interpretation of the pronoun "he" in sentences which restrict co-reference and in those which do not. The "syntactic structure" consisted of the particular lexical item, in this case the third person pronoun, plus the immediate linguistic environment, i.e., the sentence.

In the following studies "syntactic structure" is viewed as only the particular lexical items which signal the anaphoric reference. In other words, rather than comparing children's comprehension of the same anaphoric structure in varying linguistic contexts, these studies compare comprehension among a variety of anaphoric structures (e.g., comprehension of personal pronouns [he, she] is compared to comprehension of noun phrase demonstratives [that, those]).

The linguistic environment surrounding the anaphoric structure is relatively unrestricted. In the first study to be considered (Bormuth et al., 1970) the only restriction imposed by the authors is that the antecedent is "fully contained in the sentence

immediately preceding the one containing the anaphoric expression" (p. 351). The semantic and syntactic variation found in the test items is wide indeed.

The three studies are similar in design. The materials used consisted of short paragraphs, each paragraph containing a critical sentence or sentence pair. The subjects in each study answered questions designed to assess comprehension of the anaphora. Bormuth and Richek used multiple choice formats, and Lesgold used oral responses.

Bormuth, Manning, Carr, and Pearson, 1970. Bormuth et al. designed research to examine the difficulty posed by anaphoric structures and to arrange these hierarchically. The purpose of such a hierarchy was to guide the design of instruction in reading comprehension. The taxonomy of anaphoric structures was adopted from Menzel (1970). The anaphoric structures and sentence examples are presented in Table 1.

The results of the test administered to 60 fourth grade children show significant between-structure variation. The children's accuracy ranges from 64.5% (pronouns) to 86.8% (pro-clause, so).

The relatively low level of accuracy in a number of categories suggests that anaphora may indeed be a cause of comprehension difficulty. The evidence is particularly compelling when one considers that "this study included only those anaphora having an antecedent fully contained in the sentence immediately preceding the one containing the anaphoric expression" (p. 351).

Table 1
Anaphoric Structures

Pro-clause, so	Joe may go. If <u>so</u> , we will . . .
Pro adverb	He works in the cellar. It is cool <u>there</u> .
Relative pronouns	The man <u>who</u> lives next door makes. . .
Pro-verb, so-do	Joe likes tennis. <u>So does</u> Bill.
Deleted modifier	The small boy came. <u>This boy</u> is. . .
Noun phrase demonstrative	The black horse belongs to Joe. <u>That</u> is his. . .
Numeric pronominal	Several men went fishing. <u>Two</u> caught...
Inclusive pronoun	Joe, Bill and Mary went to the show. <u>All</u> enjoyed. . .
Deleted noun	There are ripe and green apples. The green <u>Ø</u> are mine.
Pro-verb, so-be/have	Joe is sick. <u>So is</u> Bill.
Negated pronoun	Bill and Joe went shopping. <u>No one</u> bought. . .
Clause demonstrative	Joe is stuck in the mud. <u>This</u> leaves us...
Semantic substitute	Those steel towers are antennas. These <u>objects</u> are...
Personal pronouns	Joe left the room. <u>He</u> had...

Note. Examples from Bormuth et al., 1970, p. 351.

Caution, however, is required in interpreting the results. In the Bormuth et al. study there were only two items assessing each anaphora type. The relative proportion of errors from the items are not reported. Furthermore the study includes no rationale as to why a particular anaphoric structure would be expected to be more complex than another. This is in contrast to Chomsky (1969) who presents both an analysis of the complexity of the structure she investigates, as well as a description of the errors that children who failed to comprehend the structure would be likely to make. The Bormuth et al. study, as reported, provides no information as to the type of errors children typically made. Since the study used a multiple choice format, errors were constrained by whatever alternatives were provided in the task.

Information concerning the reliability of items assessing the same structure and information about errors is vital in establishing the validity of the hierarchy. A prior assumption in the study is that the divisions in the Menzel taxonomy capture differences that have a significant effect on comprehension. An examination of the taxonomy (see Table 1) reveals that structures are categorized on the basis of surface structure only; they are divided according to cue words (he, she, who, so is, etc.) that appear in a sentence to signal reference to a previously stated or implied entity. In using this taxonomy to develop a hierarchy, one is either ignoring the fact that anaphora is a relationship between an anaphoric cue word and its antecedent, or one is assuming that the difficulty

posed by anaphora is independent of the type of referent or linguistic context involved. However, the range of antecedents and sentence structures in which anaphora occurs is wide indeed. These factors cannot be ignored in an analysis of anaphoric structures.

Lesgold, 1974. Lesgold conducted a partial replication study of the Bormuth et al. hierarchy in order to investigate the validity of syntax as the basis of such a hierarchy. Lesgold viewed the major problem in the Bormuth et al. study as the confounding of syntax with semantics. He points out that different anaphoric structures occur in different semantic contexts. For example, "there is no semantic (deep) structure that can alternatively be expressed as either a personal pronoun or pro-clause" (p. 333). What is also true is that the same anaphoric structure also occurs in a variety of syntactic and semantic contexts.

Lesgold's position was that if the confounding of syntax with semantics is complete, the hierarchy would be replicable. Inability to replicate the hierarchy would indicate that syntax defined in terms of surface structure of the anaphora could not be the basis for a learning hierarchy.

While basically retaining Bormuth's definition and classification of anaphora, Lesgold changed a number of factors concerning materials and test procedure. Lesgold notes that paragraphs may contain only one semantically sensible antecedent and thereby give away the answer. In the Lesgold study the number of semantically plausible answers is controlled. Further, Lesgold controls for the

"amount of processing required to get from a syntactic parsing of a sentence to an underlying cognitive representation" by counterbalancing the location of the target structure in the passage (p. 334). Lesgold used three test items per structure and recorded oral responses to test questions.

The results show that the Bormuth et al. hierarchy is not replicated. In fact there is a significant negative correlation between the two sets of means. Personal pronouns, the most difficult category for subjects in the Bormuth study, were easiest for Lesgold's subjects. Lesgold concludes:

Syntax is not the basis of a hierarchy of comprehension skills that have not been completely acquired by the time children are in the fourth grade. (p. 336)

The results of the Lesgold study demonstrate that comprehension difficulty is not a function of isolable anaphoric words such as personal pronouns, demonstratives, or noun substitutes. However, one must still account for the relatively low level of accuracy of subjects' responses. Two possibilities exist:

1. The complexity of anaphoric language exists along dimensions not clearly assessed by these studies.
2. Low scores are the result of passage factors that are unrelated to anaphora.

Some insights concerning this situation can be gleaned from a reexamination of Lesgold's experimental materials and raw data. The anaphora sentences and questions used in Lesgold's (1974) experiment

are reported in Appendix I. The following discussion is based upon the author's examination of subject response records which were supplied by Alan M. Lesgold.

A review of Lesgold's test materials and subject response records reveals the following facts about subjects' responses.

Examples follow:

1. Errors which brought down the score on a particular anaphora type often came predominately from one item rather than equally from the three items assessing knowledge of that structure.
2. Incorrect answers which are taken as evidence of failure to comprehend the anaphoric structure are in many cases semantically acceptable and plausible responses to the probe. In addition, they often provide implicit evidence that the reference was in fact comprehended.
3. Instances in which subjects chose the incorrect antecedent were infrequent when the probe was unambiguous.

The items assessing pro-verb, so-be/have demonstrate the variability of scores on items within a particular category, as well as the ambiguity of the comprehension questions and subsequent lack of anaphora-related errors. The following three items were used in the Lesgold study to assess subjects' comprehension of pro-verb, so-be/have anaphora:

1. We are having a party. Mary is coming. So is Anne.
Sometimes Anne tells stories.
Question: What is Anne going to do?
Correct response: Anne is coming to the party.

2. Bill likes animals. Tom and Jerome are watching the circus. So is Bill. Bill wants to see tigers.
Question: What is Bill doing?
Correct response: Bill is watching the circus.
3. Some days my brother and sister stay out late. Today, Sister came home early. So did Brother. Maybe they will play with me.
Question: What did Brother do?
Correct response: Brother came home early.

Only 19% of the subjects scored correctly on item 1 in this category, while 72% and 75% responded correctly to items 2 and 3 respectively. The typical answer of subjects who responded incorrectly to question 1 was "Anne is going to tell stories." This is indeed a reasonable answer to the question. Thus the typical incorrect answer to item 1 does not provide solid evidence that the anaphora was not comprehended, only that the question had a reasonable alternative interpretation. The same problem emerges again in story 2. In this story typical incorrect responses were: "Bill wants to see tigers," "He's watching the tigers," and "He's looking at tigers." Rather than providing evidence of failure to understand the anaphoric reference, these answers imply that Bill is watching the circus.

Question 3 was perhaps the most ambiguous of all. Subjects responded to the question (What did Brother do?) in these three ways: "Stayed out late"; "Came home early"; "Played with him." These answers are reasonable responses to the following three interpretations of the question.

1. What did Brother do (some days)?

2. What did Brother do (today)?
3. What did Brother do (when he came home)?

Similar problems emerge in story after story across many of the categories.

One category which is free from ambiguous questions is Noun Phrase Demonstrative.

1. The brick houses have no porches. Those are the smallest buildings. My friends have wooden houses. On rainy days we like to play inside.
Question: Which are the smallest buildings?
Correct response: The brick houses.
2. The blue drum makes a loud noise. The red ball has stripes. That is a large toy. The drum and ball are both fun to play with.
Question: Which is a large toy?
Correct response: The red ball.
3. Charles likes to wear his blue shirt. Today his mother bought some green pants. She gave the green pants to Charles. That was Charles' birthday present.
Question: What was Charles' birthday gift?
Correct response: The green pants.

Even in this category, however, the scores between items are quite disparate. They are 77%, 54%, and 97% respectively for questions 1, 2, and 3. Students who responded incorrectly to questions 1 and 2 did in fact choose the alternative semantically acceptable referent (blue drum for item 1 and wooden houses in item 2).

In summary, Lesgold's data provide only scant evidence that anaphora is a cause of comprehension difficulty. Many of the "incorrect" answers can be accounted for in terms of ambiguous

questions. The variation among the scores of items assessing the same structure is as great or greater than the variation between items assessing different structures. This casts doubt on the existence of a hierarchy defined in terms of anaphoric structures. Complexity which does exist is the result of an interaction between the anaphoric structure and other features of the text passage.

In the next study to be considered, Richek (1977) demonstrates that the complexity is the result of the interaction between the anaphoric structure and the linguistic context.

Richek, 1977. Richek designed a study even more rigorously controlled than either of the first two reading studies discussed. She tested the ability of third grade children to comprehend paraphrase sentences containing alternate anaphoric forms. For example:

1. noun: John saw Mary and John said hello to Mary.
2. pronoun: John saw Mary and he said hello to her.
3. null: John saw Mary and Ø said hello to her.
(p. 147)

In addition, the study controls for kernels, length, and parallelism. Richek did find a hierarchy in the expected direction with noun forms the easiest and null forms least comprehensible. However, the expected interaction between kernel, length, and parallelism failed to materialize. An unexpected result is perhaps more interesting. Richek states, "the two or three sentences constructed from each frame have been found to be similar in difficulty; sentences constructed from different frames have been found to be relatively

dissimilar in difficulty" (p. 334). In other words the sentence does affect difficulty, but not along the measured dimensions of complexity such as kernel, length, and parallelism.

Summary

The preceding six studies were conducted from the perspective that comprehension of anaphora can be understood in terms of a language user's knowledge of syntactic rules.

The studies by Chomsky (1969) and Maratsos (1973) isolate two of the rules which occur in some instances of anaphoric language. These studies demonstrate that there is a syntactic component to the comprehension of anaphora. They also demonstrate that care and skill must be exercised in isolating this component from other factors which influence comprehension of anaphora. The studies by Chomsky, Maratsos, and Chipman and de Dardel make evident that syntax must be defined in terms of the operation of an anaphoric structure within a particular linguistic environment.

In the reading studies (Bormuth et al., 1970; Lesgold, 1974; Richek, 1977) the meaning of "syntactic structure" is severely misapprehended. There appears to be little motivation for viewing one anaphoric structure such as personal pronouns as inherently more difficult than another, such as relative pronouns. The results of these studies as a whole leave unresolved the question of anaphora as a cause of reading difficulty.

Anaphora is clearly a complex phenomenon involving both

syntactic and non-syntactic factors. Understanding the nature of the complexity, and thereby the possible cause of comprehension difficulty, depends upon understanding the influence of the context in which an anaphoric structure is found.

The next chapter investigates schema theory as one possible framework for understanding the role of syntactic and non-syntactic factors in the comprehension of anaphora.

Chapter III

A "Model-based View" of Comprehension as a Framework for Understanding Comprehension of Anaphora

Comprehension of anaphora has become a major research issue in the field of artificial intelligence, which is concerned with the development of natural man/machine communication. Early efforts to program computers to comprehend anaphora met with failure, accompanied by the realization that semantic, social, and factual, as well as syntactic knowledge, is required in choosing the correct antecedent or referent of a given anaphoric expression.

Subsequent research has gone in two directions, both of which have important implications for understanding human comprehension. The first is an effort to analyze textual constraints more thoroughly and specify the range of antecedents and referents which correspond to anaphoric structures. The second is the development of methods to simplify the way in which the vast amount of semantic, social, and factual knowledge is organized and applied in resolving anaphoric reference.

The Range of Antecedents and Referents

Webber (1978) identified a task that had been overlooked by researchers in artificial intelligence, as well as in the language development and reading studies discussed in Chapter II. That task is "identifying what the text makes available for anaphoric reference and how it does so" (Webber, 1978, p. i). Webber divides antecedents

and referents into categories such as individuals, sets, stuff, events, activities, actions, states, propositions, generics, prototypes, and descriptions (pp. 15-20). Webber's analysis shows that the correspondence between types of anaphora and these antecedent/referent categories is far from simple. Furthermore, there are significant differences within each of the antecedent/referent categories. A simple example to illustrate this point is the range of antecedents corresponding to the singular definite pronoun "it" (see Table 2).

Webber's classification of the range of antecedents and referents, and the examples she offers, enable us to see more clearly the complexity of the phenomenon under discussion. We can begin to ask questions about the information that is required to resolve a bit of anaphoric language, as well as about the strategies or reasoning a reader must use in comprehension. Sentences three and four from Table 2 are particularly illustrative.

The phrase "Blend a cup of flour with some butter" in sentence three describes an action. However, the "it" in the following sentence (Moisten it with some milk...), refers not to the action, but to the outcome of engaging in that action. It appears that knowledge of the purpose of a recipe, as well as knowledge of the results of executing various parts of a recipe, are essential if this sentence is to be comprehended. In sentence four, again we see that the reference is not to "violinist," but to a factor associated with being a violinist--namely the instrument one plays.

Table 2
Antecedents and Referents of the
Singular Definite Pronoun "It"

Individuals

1. Mary gave Sue a T-shirt. It didn't fit.
It = the just mentioned T-shirt that Mary gave Sue.
2. Whether John buys a used car or a new bike, he will keep it in the garage.
it = the used car John buys if he buys a used car or the new bike he buys otherwise.
3. Blend a cup of flour with some butter. Moisten it with some milk, then knead it into a ball.
it = the flour and butter mixture gotten by blending a cup of flour with some butter.

Stuff

1. John bought beer yesterday, but it seems to be gone.
it = the specific quantity of beer that John bought yesterday.
2. While water covers 75% of the earth, it has not been found on the moon.
it = "generic water" (not the water that covers 75% of the earth).

Prototypes

1. Every dog at some point in its life begins to grow old. It begins to sleep more.
it = the prototypical dog.

Actions, Events, States

1. John dunked Mary's braids in the inkwell. It made her cry.
it = the specific event of John's dunking her braids in the inkwell.
2. John dunked Mary's braids in the inkwell. Although it usually made her cry, today she held back.
it = any event involving her braids being dunked in the inkwell.

Table 2

(Continued)

-
3. John dunked Mary's braids in the inkwell. Then he did it
to Sally.
it = the action of dunking someones braids in the inkwell.
-

Note. Adapted from Webber, 1978, pp. 15-20.

Although it is quite clear in these cases that the anaphora refers to something "in the reader's head" rather than to something on the page, this is to some degree always the case. Anaphoric language refers to entities that were previously stated or implied in a text and which the author assumes are still available for anaphoric reference.

Thus, the critical problem is the discovery of the manner in which knowledge is organized and a text processed so that these discourse entities remain available to anaphoric reference. Webber states the problem by asking "What is it that guarantees similar reasoning on the part of both discourse participants?" (1978, p. 2).

Comprehension of Anaphora in a Model-based View of Text

Comprehension

A model-based view of text understanding as proposed by Bransford and Johnson (1973) and Collins, Brown, and Larkin (1977) enables us to answer questions concerning the knowledge structures and processes involved in text comprehension. A model-based view of text understanding says that people "create a complex scenario or model within which the events described might plausibly occur" (Collins et al., 1977, p. 1). Collins et al. advance a theory called "A Progressive Refinement Theory of Text Understanding." A portion of their theory is outlined as follows:

The theory states that text understanding proceeds by progressive refinement from an initial model to more and more refined models of the text. The target structure

guides the construction process, constraining the models to the class of well-formed goal-subgoal structures that means-ends analysis (Newell & Simon, 1963) produces. The initial model is a partial model, constructed from schemas triggered by the beginning elements of the text. Successive models incorporate more and more elements from the text. The models are progressively refined by trying to fill the unspecified variable slots in each model as it is constructed. As the questions associated with the unfilled slots in more refined models become more and more specific, the search for relevant information is constrained more and more. The overall process is one of constraint satisfaction. (Collins et al., 1977, pp. 4-5)

Such a model-based view of text understanding is built upon a theory of the representation of knowledge developed by researchers in cognitive science and artificial intelligence. According to this theory, knowledge is organized and represented in data structures that are variously called frames (Charniak, 1975; Minsky, 1975; Winograd, 1975), scripts (Schank & Abelson, 1975), or schemata (Bobrow & Norman, 1975; Rumelhart & Ortony, 1977). In this paper I will use the term schemata which Rumelhart and Ortony define as:

data structures for representing generic concepts stored in memory. They exist for generalized concepts under objects, situations, events, sequences of events, actions, and sequences of actions. Schemata are not atomic. A schema contains as part of its specifications, the network of interrelationships that is believed to generally hold among the constituents of the concept in question. (p. 101)

An important characteristic of these schemata is that they contain variables. In describing variables, Rumelhart and Ortony draw an analogy to a play.

Just as a play has roles that may be filled by different actors on different performances, so schemata have variables that may become associated with, or bound by, different aspects of our environment on different occasions.
(p. 101)

This analogy may be made clearer by considering the often cited "restaurant script." Some of the variables in this schema are the human actors involved, i.e., customer, waiter, cook, cashier, and owner; while others are what Schank and Abelson (1975) call props, i.e., tables, menu, food, check, and money. The specific variable assignments, however, depend upon the situation, e.g., "McDonalds" versus "Sardi's."

In a model-based view of text understanding, comprehension is achieved by selecting one or more such schemata and filling in the variables both from explicit information in the passage and through inference. Thus, the model of a text consists of the relevant schemata, as well as the variables of each schema and the relationships between the variables.

Such a model is a coherent way of organizing all the elements (both explicit and implicit) which constitute a text. This is extremely important to our understanding of comprehension of anaphora, for nearly every element of a text can be accessed anaphorically. For example the simple sentence, "Mary gave Sue a sweater" contains several potential candidates for anaphoric reference. These include references to explicit discourse entities such as Sue, Mary, the sweater, and the act of giving the gift, as well as implied entities such as Sue and Mary collectively called friends or the material of

the sweater.

Mary gave Sue a sweater. It didn't fit.
It = the sweater Mary gave Sue

Mary gave Sue a sweater. She hoped Sue would like it.
She = Mary

Mary gave Sue a sweater. She tried it on immediately.
She = Sue

Mary gave Sue a sweater. This pleased her.
This = Mary's giving of the sweater

Mary gave Sue a sweater. The friends enjoy buying each other gifts.
The friends = Mary and Sue

Mary gave Sue a sweater. The wool was soft and fuzzy.
The wool = the wool of the sweater Mary just gave Sue

One could continue this sentence generation game almost infinitely. What would soon become evident, however, is that all references would be to constituents of a "gift giving schema" or "friendship schema." An analysis of the semantically sensible referents provides evidence for a schemata based theory of the representation of knowledge. Conversely, this theory enables us to see and understand still more of the phenomena involved in anaphoric language.

One curious characteristic of some anaphoric structures is that they can refer to something as specific as a noun in the preceding sentence or as general as an entire chapter. Pearson and Johnson (1978) offer an example of this in their taxonomy of anaphoric relations.

(After twenty pages discussing the causes of the Civil War.) For these reasons, the South seceded from the Union. (p. 124)

The wide range in the amount of information that can be referenced by anaphora can be understood in terms of a discourse model composed of schemata. The schemata themselves can vary in degree of abstractness, and each schema is composed of variables. Anaphora can refer to the many parts and levels of a model. These summarizing and specifying powers of schemata provide the flexibility that is needed to accommodate the wide range in the amount of knowledge that can be referred to by anaphora.

In summary, a model-based view of text comprehension is particularly powerful in explaining comprehension of anaphora. Schemata enable the reader to hold in mind the concept that has been introduced, including the variables or constituents of that concept and the relationships among them. Thus, once a schema has been instantiated, the reader has an expectation of what discourse entities may be discussed and the roles that they may play. This accounts for an author's ability to refer to entities not explicitly presented in the text, as well as the reader's ability to correctly resolve anaphora which, based upon the surface structure of the text alone, would be ambiguous. The hierarchy created among schemata, and the network of variables within each schema provide the flexibility needed to account for a reader's ability to comprehend references to the wide range of potential antecedents and referents that exist in any text. A schematic representation of

knowledge provides an explanation of the accessibility of discourse entities to anaphoric reference.

Factors Influencing Anaphora Resolution

Schema theory offers a helpful framework for understanding and investigating anaphora. Over the past decade researchers in linguistics have identified a variety of specific factors which play a part in anaphora resolution. This section of the chapter is a discussion of the way in which these many factors can be understood within the framework of schema theory.

Webber (1978) lists and discusses the factors influencing anaphora resolution that are found in the literature. The differences between factors correspond to different types of schemata that have been proposed, e.g., "problem solving schemata," "reasoning schemata," "story construction schemata," as well as schemata that underlie the events, objects, situations, etc. that are being discussed in the text. Webber discusses the factors influencing anaphora resolution in relation to the following text:

- (a) Fred left his niece at home and headed for the zoo with Mary and John.
- (b) Since the zoo was far away, they first asked a man down the block who owned a car if they could borrow it.
- (c) When they got to the zoo, Fred heard that a black mamba had just escaped.
- (d) Suddenly near John he saw the snake.
- (e) The girl saw it too, as did John.

- (f) Fred admired John because he was able to catch the snake.
- (g) Fred regretted not having a stick, since he could have used it to help John.
- (h) Luckily, the friends had each brought a bottle of wine.
- (i) John volunteered to drink them all in order to forget the black mamba. (pp. 5-6)

The following is a discussion of how five of the ten factors that Webber (1978) cites as factors influencing anaphora resolution relate to an understanding of knowledge as organized and represented in schemata.

Number/Gender Agreement. The many grammatical features that influence anaphora resolution cannot be overlooked. Number/gender agreement is perhaps the most obvious such constraint. Webber discusses how this constraint comes into play in resolving references in the passage.

In sentences (b), (c) and (i), "they" must refer to something interpretable as a set of more than one item, while in (a), (d), (f) and (g) "he" must refer to an animate entity which is not explicitly marked "female." (That "they" is taken to refer to Fred, Mary and John in sentence (b) would result from deriving such a set using the knowledge that if x does something with y and z, one may construct a referenceable set consisting of x, y and z.) (p. 6)

It must be kept in mind that grammatical constraints are but one of the factors influencing anaphora resolution--necessary but not sufficient.

Theme. Webber cites Kuno's (1976) notion of theme as one

factor that accounts for Fred's being the referent of "he" in sentence (d). Webber explains the influence of theme as follows:

According to this explanation, Fred is the theme of the discourse by virtue of being the subject of its opening sentence. The theme is the most easily pronominalizable, being what the reader is most conscious of. Hence Fred is most likely to be the referent of "he." (pp. 6-7)

The anaphora resolution in sentence (d) can be attributed to the reader's "story construction schema." Such a schema would contain information such as the idea of a dominant character who is referred to frequently throughout the story. Thus, all things being equal, this real world knowledge about story construction creates a bias in favor of the theme of the story being the most likely referent.

Recency. Recency is another factor that is believed to influence anaphora resolution. This too could be explained with reference to a "story construction schema." Webber discusses sentence (e) as a case of the influence of recency.

In sentence (e), "the girl" is understood as referring to Mary, even though two girls have been mentioned, Mary and Fred's niece. Recency--Mary being the last female mentioned--might be one factor influencing this assignment. (p. 7)

Every schema, including a "story construction schema" is based upon probabilities. A bias towards a recent entity could be the result of the frequency with which anaphora refers to characters or objects that have recently been mentioned. Although this is a possible explanation, Webber directs our attention to another

possible explanation--scene shift.

Scene Shift. A factor influencing anaphora resolution that is related to recency is called scene shift. Webber cites Rosenberg (1976), who analyzed the thematic structures of newspaper articles and found that pronominal references in this sample did not cross thematic boundaries. Mary is interpreted as being "the girl" because she is the only female who participated in the park scene. In terms of schemata, one could say that the reader has constructed a schema of the park scene. Mary has been assigned to one of its variables, while the other female, Fred's niece, has not. Fred's niece is not mistakenly identified as "the girl" because Fred's niece is not part of the model being constructed. Even a cursory examination of literature obviates the fact that characters who do not continue to play a role throughout a story cannot be reintroduced anaphorically.

Semantic Selectional Restrictions. Semantic selectional restrictions refer to the influence of a reader's semantic and factual knowledge on anaphora resolution. The correspondence between this factor and the existence of schemata representing the events or situations being described is quite clear. Webber describes how the anaphora in sentences (i) and (b) are resolved in reference to this factor:

In sentence (b), that "it" refers to the car owned by the man down the block whom John, Fred and Mary sought a car from, and not to either Fred's home or the zoo, may be explained on semantic or factual grounds, that a car is more likely to be the object of borrowing

than a house or a zoo. Similarly in sentence (i), the bottles of wine which the friends brought are more likely to be the referent of "them" than the friends themselves, since wine (and by extension, bottles of wine) are more likely to be drinkables than people are. (p. 7)

Invoking the notion of a schema appears to be an adequate way of understanding how this semantic or factual information is brought to bear in correctly resolving the anaphora. A schema for borrowing would include a variable slot for object borrowed along with characteristics of things that can be borrowed. Sentence (i) requires that the reader make an inference from bottles of wine to wine as the real referent of "them." Such an inference can easily be accommodated by a schematic representation of knowledge.

In summary, it is clear that the many factors which influence anaphora resolution can be understood within the framework of schema theory and the related model-based view of text comprehension.

Support for this perspective is offered by Collins, Brown, and Larkin (1977).

Research Supporting a Model-based View of Text Comprehension

The Collins et al. studies of readers dealing with difficult texts add validity to a model-based view of text comprehension. Their analyses of readers' protocols or self-reports provide evidence that readers use a variety of general problem solving strategies in comprehending a text and appear to be constructing a model of the text.

The Collins et al. analysis of the protocols of readers dealing with difficult texts reveals that the first step in understanding a text is deciding upon an appropriate question. For example, consider the following text from their study:

Boating Text

John and Bill were sailing on Mystic Pond and they saw a coffee can floating in the distance. Bill said, "Let's go over and pick it up." When they reached it, John picked it up and looking inside said, "Wow, there are rocks in the can." Bill said, "Oh, I guess somebody wanted the can to float there." (p. 4)

Some readers failed to comprehend the text because they focused on questions such as, "Who were Bill and John?" or "What was the intention of the people who put the rocks in the can?" rather than the major questions posed by the text such as, "Why didn't the can sink?" and "What was the function of the rocks?" (p. 29).

One can see how, barring the existence of a more specific schema, Ortony and Rumelhart's (1977) "problem solving schema" could be invoked with variables assigned in the following manner:

Problem solving schema (Person, P, Event, E, Goal, G)

1. (E) causes (P) to want (G).
 2. (P) tries to get (G) until (P) gets (G) or until (P) gives up. (p. 113)
-
1. (Seeing floating can) causes (Bill) to want (to know how can stays afloat).
 2. (Bill) tries to (find a solution) until (he) finds (a solution) or until (he) gives up.

Comprehension proceeds as subjects assign more and more of the variables in the model and develop new and better models.

Collins et al. (1977) found that readers use a variety of "puzzle solving type strategies" in making variable assignments. For example, the most frequently used strategy was "rebinding." If a variable assignment lead to a conflict, subjects tried another binding. Another puzzle solving strategy was "most likely case assignment," that is, tentatively filling a variable slot with a likely candidate in an effort to constrain the model. A third interesting strategy was "near or distant shift of focus." An example of this is attempting to constrain a different variable in the model if the one you are focusing on is not yielding to your efforts. As more variable slots are filled the model as a whole becomes more constrained and the final solution or understanding of the passage is approached.

Interestingly, these techniques are general problem solving strategies, not specific strategies for one or another linguistic structure. Anaphoric language is resolved along with general comprehension of the text. For example, consider the "Window Text" from the same study.

Window Text

He plunked down \$5 at the window. She tried to give him \$2.50, but he refused to take it. So when they got inside, she bought him a large bag of popcorn.
(p. 3)

Collins et al. state that one subject initially chose a "racetrack-betting schema" and assumed that "she" referred to the person behind the window. However, when the reader reached the

end of the passage the "racetrack-betting schema" was abandoned in favor of a "movie-going schema" and "she" was logically assigned to the "date" variable. Webber (1978) states that Charniak (1975), who has proposed a similar model of story comprehension, also observes that deductions a reader needs to make in the process of story comprehension result in anaphoric reference being resolved at no extra cost (Webber, 1978, pp. 12-13).

Anaphora's Role in Text Comprehension Reconsidered

One needs to critically examine the data and conclusions of the Collins et al. study in order to discern the real relationship between the strategies readers use in the construction of a model and the role played by anaphora in the construction of a model.

Such an examination reveals that there is a bias in a schema-theoretic approach to anaphora that may inhibit growth in our understanding of the phenomenon. In a model-based view of comprehension, anaphora is invariably viewed as a linguistic problem or impediment to human or machine comprehension. Efforts are concentrated toward finding pathways to text comprehension that are independent of the comprehension of the anaphora itself. In other words, there is an assumed directionality to the comprehension of anaphora. Schematically this could be viewed as follows:

$$\begin{array}{lcl} \text{Text Information} & + & \text{Reader} \\ \text{(excluding anaphora)} & & \text{Knowledge} \\ & = & \text{Text Comprehension} \\ & & \text{(including comprehension} \\ & & \text{of anaphora)} \end{array}$$

The anaphora is not seriously considered as part of the text

information. An alternative perspective is as follows:

Text Information + Reader = Text Comprehension
(including anaphora) Knowledge

The second model assumes that the use of anaphora is systematic and thus can provide important information to the reader.

In order to hint at the difference in perspective between the two models, let us reconsider the "Window Text." Collins et al. state that the second "she" is resolved to the "date" variable as a result of the reader's discovery that this story is an instance of the "movie going schema." An alternative perspective is that the use of the pronoun she a second time is itself one of the clues that leads the reader to the conclusion that this is an instance of the "movie going schema." The anaphora rule that is being interpreted could be stated as follows:

Repeated use of the pronoun signals that the author is referring to a previously mentioned character.

In this case then, we have one person who both offers money and buys popcorn. The "movie going schema" is one that can accomodate these facts. The two perspectives are summarized as follows:

Collins et al.:

Selection of "movie schema" → Resolution of Anaphora

Alternative

Repetition of pronoun "she" → Selection of Movie Schema

In order to appreciate the importance of the information that is provided by the repeated use of the pronoun "she," consider the

text interpretations that could be made if the second she were replaced by something more definite such as "his date." In this case we would not be able to assume as easily that the person who refused to take the money and the person who buys popcorn are in fact the same person. It would be as acceptable to assume that his date must now buy popcorn because he has given his last 5 dollars away to someone else.

Throughout this paper there has been scattered mention of research concerning the linguistic rules which govern the use and interpretation of anaphora. In the language acquisition studies reviewed in Chapter II, Chomsky (1969) and others isolated and studied various interpretation rules which govern the use of pronouns. In her review of the literature, Webber (1978) found many articles which contained observations about one or another systematic quality of anaphora such as number/gender agreement, theme, the influence of recency, etc. However, no mention was made of any attempts to thoroughly analyze the use and interpretation of the variety of types of anaphora that are found in text.

Such an analysis would logically be a prerequisite to efforts to isolate characteristics of anaphora which cause difficulty, either to humans or machines in text comprehension. It is for this reason that Chapter IV examines the literature available concerning the systematic nature of anaphora.

Chapter IV

The System of Anaphora in English

The systematic qualities of anaphora have been overlooked in much contemporary research concerning anaphora. The taxonomies of types of anaphora such as Menzel's (1970), or the taxonomy of referents and antecedents offered by Webber (1978), fail to capture differences that are vital to the interpretation of anaphora in text.

Before one can address the question of anaphora as a cause of comprehension difficulty, one must first carefully examine anaphora and discover its role and function in text and the relationships between anaphors and their antecedents.

A resource that has been overlooked in much research concerning anaphora is Halliday and Hasan's work Cohesion in English (1976). Cohesion in English is a systematic and comprehensive account of the ways in which the various structures labeled anaphora function in text.

Halliday and Hasan begin by explaining the basic function of anaphora in the language system. Anaphoric structures are defined as the resources in the language system for linking together parts of a text which are structurally unrelated. The term "cohesive tie" is used to describe the relationship between an anaphora and its antecedent. In analyzing and categorizing anaphora, both sides of the anaphoric relationship, the anaphoric

item and its antecedent, are considered.

Halliday and Hasan create order out of chaos by dividing the many anaphoric structures into just five groups based upon important differences in the relations in text that they express. Then within each group subclasses, and in many cases even finer divisions, are delineated. Such an approach elucidates important generalizations about the phenomenon of anaphoric reference, in addition to providing a systematic account of the individual differences among anaphora within each major category.

In addition to an analysis of the various types of anaphora, the potential that resides in analyzing the "patterns" of anaphora in text is explored. In other words, beyond understanding the relationship between individual anaphora and their antecedents, much can be learned by examining the number, types, and locations of various cohesive features (anaphora) that are found in an entire text or segment of a text. Halliday and Hasan provide a well developed system for such an analysis.

The remainder of this chapter falls into four major parts. First, the underlying tenets of Halliday and Hasan's work concerning cohesion in English will be reviewed and compared to the perspectives of reading research and schema theory. This discussion will be followed by a brief review of the five categories of anaphora. The third section examines Halliday and Hasan's method of analyzing the cohesive structure (patterns of anaphora) of texts and reviews the research by Gutwinski (1976) using this method. The

chapter concludes with a discussion of the relationship between cohesive structure and discourse structure and the implications of this relationship for reading research.

The Role of Anaphora in the Language System

A very important linguistic as well as psychological question is what makes a text a text. In other words, how is a text different from a group of unrelated sentences. Thorndyke and Yekovich (1979) capture many of the distinctions in their description of the differences between a coherent story and a set of unrelated sentences.

A coherent story differs from a set of isolated sentences in that it has a unifying context, a recognizable temporal sequence of events, and a fixed set of actors or topics. A typical story presents events in an orderly manner, supplying (either explicitly or implicitly) motivations for the characters, causes and consequences of the events, and cues to the temporal sequence in which the events occur. (pp. 17-18)

In some sense a text is a unified whole and there is general agreement among readers as to whether a particular group of sentences is a text or merely a collection of unrelated sentences. Our knowledge of the rules governing the generation and interpretation of text, however, is largely unconscious, just as is our knowledge of the rules governing the generation of individual sentences in our language. It is possible, however, to analyze texts and discover objective features which characterize texts but are not found otherwise. This is precisely what Halliday and Hasan (1976) have done in their study of "cohesion" in English. In the introduction

to Cohesion in English they write:

What we are investigating in this book are the resources that English has for creating texture. If a passage of English containing more than one sentence is perceived as a text, there will be certain linguistic features present in that passage which can be identified as contributing to its total unity and giving it texture.
(p. 2)

The text forming features that Halliday and Hasan analyze are the anaphoric structures that have been discussed throughout this paper. The relationship between an anaphoric structure and another part of the text is described as a "cohesive tie." The concept of cohesion is explained as follows:

Cohesion occurs when the interpretation of some element in the discourse is dependent on that of another. The one PRESUPPOSES the other, in the sense that it cannot be effectively decoded except by recourse to it. When this happens, a relation of cohesion is set up, and the two elements, the presupposing and the presupposed, are thereby at least potentially integrated into a text.
(p. 4)

Thus, anaphora plays a very important role in the language system. Cohesive ties (anaphora) signal continuity in meaning in a text. To relate this to a model-based view of comprehension, one could say that cohesive ties guide the reader in the correct synthesis of a model of the text by indicating what elements in the text, and hence in the reader's model are related.

Although Halliday and Hasan do not make such psychological claims concerning human comprehension on the basis of their linguistic analysis, psychological implications are nevertheless

present. Cohesive features are clearly viewed as guiding the reader in the correct interpretation of a text by assisting him in filling in "information gaps" that exist in text. A passage from the end of their book is a clear expression of this perspective:

The continuity that is provided by cohesion, consists, in the most general terms, in expressing at each state in the discourse the points of contact with what has gone before. The significance of this lies in the simple fact that there are such points of contact: that some feature or some thread of argument persists from one moment to another in the semantic process, as the meanings unfold. But it has another more fundamental significance which lies in the interpretation of the discourse. It is the continuity provided by cohesion that enables the reader or listener to supply all the missing pieces, all the components of the picture which are not present but are necessary to its interpretation. (p. 299)

Halliday and Hasan offer the following example as an illustration of a situation in which the use of pronoun anaphora would guide the reader in making the correct assumption as to the identity of the person in the second sentence.

John took Mary to the dance. John was left alone.
(p. 281)

Using a pronoun in place of the second John would make it clear that the author is talking about the same John as in the first sentence.

In other words, we use a reference item; and this conveys the meaning 'the present sentence is related to the last one by the fact that both contain a reference to the same individual.' (p. 281)

The viewpoint that anaphora carries meaning that can assist a

reader in text understanding is very different from the approach taken in the reading studies. For example, a major hypothesis of Richek's (1977) study was that repetition of the proper noun would be easier to comprehend than pronoun or null anaphora.

Gutwinski (1976) reports an interesting experiment which adds support to the thesis that anaphora acts as a guide in text comprehension. In his experiment, college students were given a "text" consisting of 12 sentences randomly selected from consecutive pages of Hemingway's "Big Two Hearted River: Part 1." Students were asked to comment on them in regard to their meaning and structure.

Gutwinski reports the results as follows.

The students tried to interpret the sentences as a whole or at least several sentences in a group. They tried also to rearrange them, improve anaphora, transitions, etc. so that the sentences made more sense. Only a few recognized finally that they were not examining a text but a group of unconnected sentences. Interestingly enough, many of the grammatical and lexical signals they were searching for in order to explicate those supposed passages were of the kind studied here as cohesive features. (p. 55)

The viewpoint that anaphora helps the reader supply missing information is very different from the perspective of schema theory. In an artificial intelligence model such as Charniak's or a model-based view of comprehension, it is the reader's provision of missing information which makes anaphora resolution possible.

Resolution of anaphora should not be seen as a product of comprehension of a text, nor is it fair to say that anaphora in and of itself expresses the relations between parts of a text. The truth

lies somewhere between the two. Various anaphoric expressions relate in systematic ways to other parts of a text. Anaphora marks that there are points of contact between the parts of a text and the form of the anaphoric expression limits the range of the possible antecedents. This facilitates the reader in making appropriate inferences. Needless to say, however, without appropriate real world knowledge and an understanding of the anaphoric system, comprehension can be impeded.

In order to understand what information is provided by anaphora in text let us turn to an examination of the categories of anaphora delineated by Halliday and Hasan (1976).

Categories of Anaphora

Anaphora can be divided into the five major categories of reference, substitution, ellipses, conjunction, and lexical cohesion (Halliday & Hasan, 1976). These categories cover all the forms of anaphora that have been discussed in this paper. Halliday and Hasan refer to these structures as cohesive features rather than as anaphora. The word anaphora is reserved to express the direction of a cohesive relationship. Anaphoric means that the presupposed item is in a preceding part of the text and cataphoric refers to forward referencing. Members of every category of cohesion can operate anaphorically. Halliday and Hasan point out, that in fact, the typical direction of a cohesive tie is backwards or anaphoric. It usually makes more sense to presuppose something which has

preceded in the text than to presuppose what will follow. For the sake of consistency with earlier chapters of this thesis, the cohesive features of text will continue to be referred to as anaphora.

Halliday and Hasan devote the largest portion of their work on cohesion to the description of the various categories of anaphora and the way in which the members of each category function in text. It is impossible to adequately summarize the thorough analysis they present. The present discussion is limited to a summary of the motivations for grouping anaphora into the five major categories. Appendix II contains Halliday and Hasan's "Summary of Cohesion and Coding Scheme."

Reference. The first category to be considered is reference. This category includes personals, demonstratives, and comparatives (see Appendix II). Categories of anaphora are established on the basis of two criteria: (a) the nature of the relation and (b) the form of the expression. The shared characteristics which serve as the motivation for grouping the personals, demonstratives, and comparatives together is that these text features signal identity of reference and this relatedness of reference is expressed through grammatical means. In other words, reference items signal cases in which the same entity enters into the discourse a second time. The form of the expression is termed grammatical because it relies upon the grammatical systems of person, number, proximity, and degree of comparison (p. 303).

Halliday and Hasan stress that reference is a semantic

relationship--a relationship in meaning. They state, "Neither the syntactic function of the personal itself, nor the syntactic function of its referent has any bearing on the anaphoric relation between the two" (p. 54). To illustrate this point they offer the following description and examples.

The other personal forms, both possessive determiners (my, your, etc.) and possessive pronouns (mine, yours, etc.), may refer without restriction to a referent having any of the functions of John in (2.21), or indeed any other syntactic function that is open to nominal. So we could have any combination of the following:

- | | |
|-----------------------------------|---|
| a. John has moved to a new house. | x. <u>He</u> had it built last year. |
| b. John's house is beautiful. | y. <u>His</u> wife must be delighted with it. |
| c. That new house is John's. | z. I didn't know it was <u>his</u> . |

where (x) has personal pronoun he, (y) has possessive determiner his and (z) has possessive pronoun his.
(pp. 54-55)

The personal "he" and "his" signal identity of reference to John because they carry the grammatical markings of singular and masculine but the syntactic function of John or the personals is irrelevant to the anaphoric reference.

Substitution. Reference and the next category, substitution, are different in that substitution relates "linguistic elements" rather than semantic identity. The form of the expressions in this category, however, is also grammatical. The following sentence pairs illustrate the major difference between the categories of reference and substitution:

Would you like this teapot? No, I don't want it.
it = the identical teapot mentioned in the first sentence.

Would you like this teapot? No I want a red one.
one = a different member of the same class of things (teapots) that was mentioned in the first sentence.

Substitution enables a speaker or author to establish a new referent by contrasting it to a previously mentioned lexical item. The nature of the relation expressed by substitution and its contrastive function are described as follows:

In reference there is typically an identity of referent. Substitution is used where there is no such identity. This requires a device which makes the connection at the lexicogrammatical level, at what we called the level of 'wording', since the cohesion takes the form of 'same element in the language (same wording) but different referent.' The essence of substitution therefore is contrast; a new referent is being defined and hence there is no substitution for proper names. The contrast is not necessarily in the reference; it may be some interpersonal element in the meaning--the modality, key attitude etc.--but the principle is the same. Reference implies that there is identity of meaning between the presupposing item and what it presupposes, while substitution implies non-identity of meaning. (p. 314)

Ellipses. Halliday's third category, ellipses, is very similar to substitution. One way to view ellipses is as "substitution by zero." In substitution there is an item which serves as a counter for what is left unsaid. In ellipses there is merely the implication that there is something left unsaid but nevertheless understood. Ellipses is like substitution because it signals the actual item in the text that would appropriately fill the empty slot. Substitution and ellipses preserve the form of the antecedent

and thus are subcategorized according to the grammatical class they preserve. The three categories are nominal, verbal, and clausal. The following sentence pairs illustrate the various types of substitution and ellipses:

Nominal Substitution	Do you like the new chairs? No, I like the old <u>ones</u> .
Verbal Substitution	Did you go to the concert? No, but Sally <u>did</u> .
Clausal Substitution	Todd is in the bicycle race. <u>So</u> is his brother.
Nominal Ellipses	Three cars crossed the finish line together. A fourth $\emptyset$ was close behind.
Verbal Ellipses	Have you ~~been~~ jogging? Yes I have $\emptyset$.
Clausal Ellipses	Has the weather been rainy? Yes it has $\emptyset$.

Conjunction. Conjunction is one of the most intriguing types of anaphora. Conjunctive words and phrases themselves carry meaning to a greater extent than the lexical items classified under the headings of reference and substitution. The text relation marked by conjunctives is described in this way:

With conjunction, on the other hand, we move into a different type of semantic relation, one which is no longer any kind of search instruction, but a specification of the way in which what is to follow is systematically connected to what has gone before.
(p. 227)

Conjunctive elements express logical relations. Halliday and Hasan divide the conjunctives into four groups according to the

logical relation they express: additive, adversative, causal, and temporal. The following sentences exhibit the four types of logical relations that are expressed by conjunction:

For the whole day he climbed up the steep mountainside,
almost without stopping.

Additive And in all this time he met no one.

Adversative Yet he was hardly aware of being
tired.

Causal So by night time the valley was
far below him.

Temporal Then, as dusk fell, he sat down
to rest. (pp. 238-239)

Lexical. The last category of anaphora is lexical. Lexical anaphora bears some resemblance to both reference and substitution. One type of lexical anaphora which operates similarly to reference is reiteration.

Halliday and Hasan use the term reiteration to describe lexical cohesion in which a "lexical item refers back to another to which it is related by having a common referent" (p. 278). Reiteration can be described in terms of a continuum which ranges from the repetition of an item to the use of a personal reference item:

I turned to the ascent of the peak.

The ascent
The climb
The task is perfectly easy. (p. 279)
The thing
It

As shown in the above sentences, reiteration can take the form of the same word, a synonym or near synonym, a superordinate, or a general word (p. 279). The following scheme illustrates the forms of reiteration and the referential relation they express:

Type of lexical cohesion	Referential relation
Reiteration	
(a) same word (repetition)	(i) same referent
(b) synonym (or near synonym)	(ii) inclusive
(c) superordinate	(iii) exclusive
(d) general word	(iv) unrelated
(Halliday & Hasan, 1976, p. 288)	

The second major subclass of lexical anaphora is collocation. Collocational anaphora is the occurrence of a lexical item in the context of other related lexical items. Words related by this type of anaphora can stand in a variety of relationships to one another. Examples include words in the same ordered series such as days of the week, words which express whole/part relations such as car, wheel, seatbelt, etc., or relationships which are not as easy to specify such as work and office, reader and writer, etc. Lexical collocation is similar to substitution in that lexical items are related elements rather than references to the identical text entity.

The cohesive strength of related items depends upon how closely the items are related in the linguistic system as well as their physical location in the text. Concerning the importance of lexical anaphora, Halliday and Hasan state:

However luxuriant the grammatical cohesion displayed by any piece of discourse, it will not form a text unless this is matched by cohesive patterning of a lexical kind. (p. 292)

Although Halliday and Hasan categorize anaphora in a more meaningful way than the Menzel (1970) taxonomy which was used in the reading studies, this does not necessarily mean that their classification system could better serve as the basis for a hierarchy of difficulty of anaphoric structures. The difficulty of a particular anaphoric expression in a text depends upon a host of factors such as the anaphoric category involved and the surrounding context and the location of the antecedent, as well as the reader's real world knowledge. It is probably safe to say that all school age children would be able to comprehend every type of anaphora in some contexts, and equally true that it would be possible to create contexts in which various types of anaphora would be difficult to comprehend, even by adults.

A more fruitful avenue of research may be discerned by reflecting upon the purpose or role of anaphora in text. Halliday and Hasan describe anaphora as the resources in the language for creating texture by linking together various parts of a text. Therefore, one possible area of investigation is to examine how all the anaphoric structures in a segment of discourse work together to make that discourse a text rather than just a set of unrelated sentences.

Patterns of Anaphora

Halliday and Hasan developed a method for the analysis of the "cohesive structure" of text. The cohesive structure of a text is formed by all of the anaphoric ties operating in that text. An analysis of the cohesive structure of a text is conducted in the following manner:

For any sentence, therefore, we shall indicate, first of all, how many cohesive ties it contains: how many instances of a cohesive element that are not resolved by presupposition within the sentence. This shows the total extent of the demands it makes on the preceding (or rather surrounding) text. Secondly for each of these ties we shall specify what type of cohesion is involved, in terms of reference, substitution and so on; this can be specified to a varying degree of delicacy. . .
(p. 332)

Cohesion in English (Halliday & Hasan, 1976) ends with the analyses of eight short passages. These examples are offered only to demonstrate the method for analyzing the cohesive structure of texts. There are no comments, conclusion, or generalizations about the cohesive structure of text based upon the analyses of these eight passages. Such a seemingly inconclusive conclusion to a treatise on cohesion is reasonable in light of the fact that the system is a general technique for answering questions about cohesive structure. The way in which it is used depends upon the questions one wishes to answer and the authors leave these choices to the reader (p. 332).

In presenting a framework for the analysis and notation, of a text, however, we should emphasize the fact that we regard the analysis of a text in terms of such a

framework as a means to an end, not as an end in itself. There are numerous reasons why one might undertake such an analysis, and the enquiry will lead in all kinds of different directions; it is likely to mean one thing in the context of the teaching of composition, another thing in the context of automatic analysis of text by computer, and something different again in the context of stylistic studies. (p. 332)

Evidence of the usefulness of Halliday and Hasan's system of analysis is provided by the research of Gutwinski (1976), who applied the method in the analysis of the prose of two American authors. The next several pages contain a summary of Gutwinski's research and findings, followed by a discussion of the relationship between the cohesive structure of a text defined in terms of the patterns of anaphora it exhibits, and the underlying coherence at the level of meaning or logical relationships which exist between segments of the text.

Gutwinski (1976) analyzed the cohesive structure of texts to determine whether differences in literary style would be reflected in the choices of cohesive ties the authors employed in their writing. Gutwinski analyzed passages of approximately equal length (same number of sentences) written by the American authors Henry James and Ernest Hemingway.

Gutwinski did in fact find clear differences in the types of cohesion employed by the two authors. Much of the cohesion in the James passage is the result of reference, especially the use of personal (personal pronouns, possessives, etc.) (p. 124). Hemingway also relies upon reference, but makes greater use of lexical cohesion

(word repetition, use of related words, etc.) than James (p. 137).

An interesting similarity, however, is the density of cohesive features (anaphora). Hemingway uses one cohesive tie per 7.5 words while James uses one cohesive tie per 6.8 words (p. 128). Thus, while they make different choices in the type of cohesion they employ, the density of cohesive ties is very similar. Gutwinski reports that "both authors depend mainly on anaphora for grammatical cohesion and within anaphora on the third person pronouns and personal possessives" (p. 131). Cohesive features (other than personal pronouns and personal possessives) which referred to participants always had an antecedent stated in the preceding sentence or repeated in the same sentence.

Gutwinski's analysis reveals some interesting "patterns" of anaphora in the passages. The most distinctive pattern is made by the personal pronouns and possessives which refer to the main characters in the James story. The use of pronouns mark the lines of participant involvement in the story. Anaphoric reference to the characters occurs sentence after sentence in a nearly unbroken line. The largest uninterrupted span is 17 lines long. All 17 sentences contain either "her" or "she" referring to Isobel, the main character in the story (p. 113). Gutwinski comments on the importance of these chains of anaphora in the James text.

Although there are some gaps in these lines they seem to provide the backbone for the cohesion of the whole paragraph with other cohesive elements reinforcing that cohesion by supplying additional connectedness for various smaller groups of sentences. (p. 112)

Thus, in these narratives, cohesive features which did not mark participant involvement linked elements which were important to smaller segments of the texts.

In the James passage there was only one sentence which contained no cohesive ties. The Hemingway passage, however, had a number of such sentences. Gutwinski notes that these sentences can be re-ordered in the passage or removed completely without affecting the general unity of the passage (pp. 151-152).

The Relationship Between Text Cohesion and Text Coherence

The importance of many of Gutwinski's findings lies in the evidence they provide of the relationship between cohesive structure and discourse structure. Gutwinski's analysis demonstrates that anaphora, especially the personals, express the participant involvement in the discourse. Other types, particularly the conjunctives, express logical relations which underlie the text. Lack of cohesive features in a sentence seems to indicate that the sentence is relatively unimportant, or at least not closely bound to the structure of the discourse as a whole.

Based upon the analysis of cohesive elements by Halliday and Hasan (1976) and the findings of patterns of anaphora in coherent text by Gutwinski (1976), it is clear that there is a very strong relationship between text coherence and cohesive structure. Cohesive elements (anaphora) are the features of the language which enable the speaker or writer to express in the surface structure of a text, the logical relations at the level of deep structure.

Because of this relationship, the analysis of the cohesive structure of a text may serve as a very good index of the strength of the coherence of the text. Therefore, the analysis of the cohesive structure of texts, a far simpler task than the analysis of text coherence, could serve as a very useful tool in investigations concerning discourse structure.

In order to further examine the relationship between cohesion and coherence, let us compare an analysis of text coherence (Hobbs, 1978) to an analysis of the cohesive structure of the same text.

Hobbs (1978) presents a formal characterization of coherence in terms of binary relations that correspond to the type of inference a reader makes in comprehending the relations among various parts of a text. Hobbs states:

Coherence in discourse can be characterized by means of a small number of coherence relations which are definable in terms of the operations of an inference system. If an utterance strikes one intuitively as a coherent continuation of the discourse, then there is some coherence relation that holds between the utterance and some portion of the preceding discourse. If it strikes one as incoherent, no such relation exists. (p. 3)

Hobbs presents the following sentences as an example of text linked by the inference relation of elaboration.

John can open Bill's safe. He knows the combination.
(p. 2)

Hobbs' formal definition of elaboration and his discussion of this particular instance of elaboration are as follows.

A segment of a discourse S1 is an elaboration of S0 if the same proposition P can be inferred from both S0 and S1, and one of the arguments of P is more fully specified in S0. (p. 3)

In (1), S0 is the first sentence, S1 the second. The proposition that can be inferred from both sentences is that John knows some action it is possible for him to perform that will cause the safe to be open. This action--dialing the combination, rather than, say, blasting the safe with dynamite--is more fully specified (implicitly, of course) in the second sentence than in the first. (p. 3)

The two sentences Hobbs offers clearly meet his requirements for being a coherent text. As would be expected, these sentences also display cohesion. There are two cohesive ties between the sentences. One is the reference item "he" which indicated that the same participant, John, is also involved in the second sentence. The second tie is the lexical tie between safe and combination. In addition the word "combination" is preceded by the definite article "the" which indicates that there is a specific entity which is recoverable to the reader. In this case "the combination" refers to the combination of the safe mentioned in the first sentence.

An analysis of the cohesion of a text does not describe the inference process which underlies the recovery of meaning, but does mark the text entities involved in the coherence relation. In the above examples these entities are John and the combination. It appears that if there is coherence as defined by Hobbs, one will find corresponding cohesive features and vice versa.

Surprisingly, however, Hobbs does not agree that cohesion and

coherence are necessarily related. He offers this example of sentences which he feels display cohesion but not coherence.

Jimmy Carter proposed a massive energy program. He used to cultivate peanuts. (p. 5)

It is true that these sentences are not very coherent, but they are not totally incoherent either. With effort one could conceive of a situation in which they would be related. One such situation might be if the speaker were deliberately noting the contrast between Carter's past and present responsibilities. Contrary to Hobbs' opinion, these sentences display only weak cohesion. There is only one cohesive tie between the sentences--the personal reference item "he" which refers to Jimmy Carter. There is no lexical cohesion whatsoever. Other examples Hobbs offers to demonstrate the inference relations which underlie a coherent text, however, contain a greater number of cohesive features and display lexical as well as grammatical cohesion.

It appears that rather than being unrelated, text cohesion and text coherence systematically co-vary. The more coherent a text is, the more evidence of cohesion one will find and vice versa.

In summary then, analyzing the cohesive structure of a text will not describe the underlying coherence in terms of the inferences required or the outside knowledge to be contributed by the reader, but it will provide a strong indication of the strength of the coherence that a further analysis would reveal.

Text coherence and cohesion are strongly related. A text is

coherent because at some underlying level there are logical relations in meaning. A text is cohesive because the systematic resources of the language (anaphora) are used to mark these relations. Hence, it is unlikely to find either (a) a coherent text that displays little or no cohesion or (b) a cohesive text which is not coherent.

Because of the strong relationship between coherence and cohesion, the analysis of the cohesive structure of texts is potentially a useful tool for discovering important characteristics of texts. Some of the potential benefits of such analyses are discussed in Chapter V.

Chapter V

Anaphora: Directions for Future Research

The progress made in the study of anaphora has been substantial, but scattered across a variety of disciplines. The complementary nature of the information and insights gained across the fields has been obscured both by the different natures of the questions that have been asked, and by the lack of communication among researchers in different disciplines.

The many disciplines involved in the study of anaphora have highlighted various aspects of the comprehension of anaphora. Each makes a significant contribution to a full understanding of the function of anaphora in text, and the process by which humans comprehend anaphora. The approaches to anaphora which have been discussed in this paper are summarized below.

Summary of the Research

The developmental language studies (Chomsky, 1969; Maratsos, 1973) were early contributions toward an understanding of children's ability to comprehend pronoun reference. Chomsky's study from within the framework of transformational-generative grammar is a valid and useful investigation of a small piece of the anaphoric puzzle--the limited case in which a pronoun may not refer to an element in the same sentence. Maratsos (1973) investigated children's awareness of stress as the clue in resolving a pronoun to the appropriate antecedent in a sentence. In both of these studies, sentence

structure influences the assignment of the antecedent. Thus the findings do not apply to the more typical situation in which anaphoric relations cross sentence boundaries and are unaffected by sentence structure.

The reading studies (Bormuth et al., 1970; Lesgold, 1974; Richek, 1977) failed to produce conclusive evidence concerning the difficulty involved in the comprehension of anaphora, but in their failure demonstrated the complexity of the phenomenon and the need to take factors other than syntax into consideration in the study of anaphora.

Work in artificial intelligence has elucidated types of information other than syntactic knowledge that are necessary for text comprehension in general and especially for the correct resolution of anaphora. The need to organize this information in an accessible and economical form led to the creation of the schema as a possible information structure. The equivalence between the information structures and processes required for computer comprehension and the structures and processes actually employed by humans is, and will continue to be, an important area of investigation. It is at least safe to say that the real world knowledge of the reader is an essential component of text comprehension and especially the comprehension of anaphora. Schemata are reasonable and useful models of the way in which such knowledge is organized.

Computer comprehension would be greatly facilitated if one could reduce the amount of knowledge from outside the text that is

required to make sense of the text. Halliday and Hasan's (1976) analysis of types of anaphora highlights textual regularities in the relations between anaphoric structures and their antecedents, and is therefore a step in this direction.

Halliday and Hasan's greatest contribution is their elucidation of anaphora's role in linking together the various parts of a text. Gutwinski's (1976) application of Halliday and Hasan's method for analyzing the cohesive structure of text indicates that valuable information about discourse structure may be gained by analyzing the patterns of anaphora in text. It appears that the cohesive structure of a text in some way parallels its underlying coherence. The relationship between cohesive structure and text coherence warrants much further investigation.

In my opinion, Halliday and Hasan's work Cohesion in English has been the most significant contribution to an understanding of the phenomenon of anaphora. It is for this reason that I will begin the discussion of future directions for research by commenting upon the benefits of pursuing analyses of the cohesive structure of texts.

Implication for Future Study

Although it is difficult to speculate on the value of the information that may emerge from the analysis of the cohesive structure of texts, I would like to discuss a few of the areas that current research indicates are worth pursuing.

The most obvious value of such analyses is simply to gather empirical data in order to determine whether or not there are fairly stable "patterns of anaphora" in text. Such analyses may proceed at a variety of levels. Using Halliday and Hasan's method one can seek information concerning the density of anaphora and the behavior of the various categories of anaphora, as well as the overall cohesive structure of texts. Since it appears, based upon Gutwinski's (1976) findings, that patterns of anaphora vary according to type of text (genre, author's style, etc.), such analysis should always be contrastive--that is, compare patterns of one text type to the patterns of other text types.

One's choice of text type for study depends upon one's research purposes. In reading research, a possible beginning point would be the analyses of the stories in children's basal readers in contrast to children's "best sellers." Another possibility is the analysis of cohesive structure of stories in comparison to subject matter material such as children's science or social study texts. It is very likely that the cohesive structures of these text types will be markedly different. As Gutwinski's (1976) analysis demonstrated, much of the cohesion in stories is the result of pronoun reference to the characters in the stories. Since informational material does not usually have characters, the authors will have to rely upon other types of anaphora for cohesion.

The information gained from the analysis of the cohesive structure of text could assist the authors of these materials in making

their materials more comprehensible. Such information would also assist researchers in designing experimental materials which more accurately reflect the demands of ordinary text.

Another major contribution of the analyses of the cohesive structure of text may be in the area of readability research. A coherent text is easier to read than an incoherent one. Because of the relationship between cohesion and coherence in text, the analysis of the cohesive structure of text may help in isolating specific factors which contribute to its overall readability.

In the reading studies (Bormuth et al., 1970; Lesgold, 1974; Richek, 1977) an unexplained outcome was the high level of errors combined with the lack of any consistent pattern in relation to the "types" of anaphora involved. One possible explanation for the errors is that the texts displayed generally poor cohesion and were therefore difficult for the subjects to comprehend. It is possible that in trying to isolate and study individual forms of the anaphora that these researchers destroyed anaphora's function which is to express the relations in meaning between various parts of a text.

The "stories" used in the Lesgold study (see Appendix A) intuitively strike one as incoherent. They are more similar to sets of unrelated sentences than to a unified story. As would be expected, they provide little evidence of cohesion, with adjacent sentences sometimes having no cohesive link. A large part of the cohesion in these stories is the result of lexical cohesion. Grammatical cohesion is generally very weak. The following story

illustrates some of the weaknesses of these texts.

The old man likes candy. He is fat.
The boy is eating a piece of cake. He likes to ride
his bike.

The first two sentences in the story are cohesive as a result of having the same participant which is marked by the use of the pronoun "he" in sentence two. The third and fourth sentences also are linked through pronominal reference. There are no cohesive ties between the first two sentences and the last two sentences, other than the somewhat weak cohesion created by a lexical relationship between cake and candy.

Research concerning cohesive structure must be largely exploratory with an open eye toward significant patterns that may emerge. With further study it may be possible to isolate an easily measured feature, such as density of anaphora, which could be combined with more traditional measures of reading difficulty such as the number of words per sentence and average word length, to improve upon current readability formulae.

A major point of agreement among Webber's research (1977a, 1978) concerning computer comprehension of anaphora, the research advancing a model-based view of text comprehension (Collins et al., 1977) and the linguistic analysis of Halliday and Hasan (1976) is that anaphora is a semantic relationship. For example, Halliday and Hasan point out that reference is not made to a linguistic element, but to a semantic entity. Webber (1977a) expresses a similar idea as a basic

assumption guiding her survey of research on anaphora.

The first (assumption) is that anaphoric expressions do not refer to segments in a text or discourse, but to entities which are assumed to be in a language receiver's mind. (Webber, 1977a, p. 1)

If readers build a model in their heads consisting of the entities involved and the relationships among them, it is likely that the linguistic form of the anaphoric structures and antecedents will be dropped with only the semantic relationships stored. Two investigations to test the validity of a model-based view of comprehension are outlined below.

If readers resolve anaphora to entities in their minds, rather than to the exact form of the antecedent in the text, then a reader's identification of an antecedent may, in some cases be semantically correct, while linguistically different from the antecedent stated in the text. For example, many stories use a variety of nouns and pronouns to refer to the same character (e.g., Juliette Jones, Mrs. Jones, Dr. Jones, Juliette, the tall woman, she, etc.). An interesting research question is how readers will respond if they are stopped after a reference to a character and asked to identify the referent. Possible answers include (a) repeating the most recently given proper noun, (b) consistently using the same proper noun for every reference, (c) using several of the proper nouns and other identificational phrases such as "the woman in the story." If readers consistently use the same name in talking about a character in the story it would indicate that they are in fact resolving the

anaphora to an entity in their heads rather than to the linguistic form in the passage.

Another investigation concerning the way readers comprehend anaphora could be conducted using questions which focus on the linguistic forms of anaphora and their antecedents in comparison to questions which focus on the semantic relationships in the text. For example, consider the following comprehension exercises in which a student is directly questioned about the anaphora.

The story says: "Spring wheat is planted in spring. It is harvested the same summer." The word it means _____. (Liddle, 1977, p. 97)

The story says: "When people travel into space, they must use a rocket engine." The word they means _____. (Liddle, 1977, p. 59)

Children's understanding of the semantic relationships in these stories could be assessed using questions such as:

What is harvested the same summer it is planted?
When is wheat harvested?

Who uses rocket engines?
What do people use to travel in space?

It is likely that these questions would be easier to answer than the questions which focus directly on the anaphora in the story. The two question types do not assess the same knowledge. Anaphoric forms are themselves meaningless. They are meaningful only insofar as the reader replaces them in his or her mind with the appropriate reference or substitution item. A direct task such as "What does it mean?" asks the reader to take two steps backward and reflect

upon the linguistic form that led to the comprehension of the passage. Comprehension of anaphora may be an automatic process that proceeds with little conscious awareness of the anaphoric items themselves.

In conclusion, I would like to return briefly to the question posed at the beginning of this thesis. Is anaphora a cause of difficulty in reading comprehension? This paper has not answered this question, but I hope it has elucidated the complexity of anaphoric language and the variety of factors which can contribute to such difficulty.

More importantly, I hope that this paper will contribute to an awareness and appreciation of the significant role played by text anaphora. Anaphora is a pervasive element of language which makes it possible for the reader to comprehend the relationships among the parts of a text. Thus, the study of anaphora can contribute to an understanding of the structure of discourse as well as to an understanding of the psychological processes by which humans comprehend language.

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APPENDIX A

Anaphora Experiment Materials

1. Personal Pronouns

a. short

1. The old man likes candy. He is fat. The boy is eating a piece of cake. He likes to ride his bike.
Who is fat?
2. The white shoe is under the bed. The brown shoe is dirty. It needs to be cleaned. I can't find the black shoe.
Which shoe needs to be cleaned?
3. The brothers took a long ride. They rode a car. Janet and Gloria got on the bus. They went home.
Who went home?

2. Relative Pronouns

a. short

1. The brown dog who was missing has been found. The lady was taking her dog for a walk. She saw a white dog eating a bone.
Who was missing?
2. We have a surprise at our house. My gray cat who likes to play with dogs has kittens. My friend in the country has a black cat.
Who likes to play with dogs?
3. Two men walked down the street. One man had on a hat. The big man who is standing on the corner is my father.
Who is standing on the corner?

3. Noun Phrase Demonstrative

a. short

1. The brick houses have no porches. Those are the smallest buildings. My friends have wooden houses. On rainy days we like to play inside.
Which are the smallest buildings?

2. The blue drum makes a loud noise. The red ball has stripes. That is a large toy. The drum and ball are both fun to play with.
Which is a large toy?
3. Charles likes to wear his blue shirt. Today his mother bought some green pants. She gave the green pants to Charles. That was Charles' birthday gift.
What was Charles' birthday gift?

4. Negated Pronoun

a. short

1. Five boys went fishing. No one caught anything. Tyrone and his friend were chasing butterflies. Everyone had a good time.
Who didn't catch anything?
2. Gloria and the boys ate a box of cookies. No one got sick. Kathy and her sister sell cookies in the summer. They like to eat them too.
Who didn't get sick?
3. Some animals don't play nicely together. Our bird and rabbit must be kept apart. The cats and dogs fight a lot. No one gets hurt.
Who doesn't get hurt?

B. PRO-VERBS

1. Pro-Verb, so-do

a. short

1. The dog tore paper. So did the cat. We also have goldfish at our house. The cat likes to run after a ball of string.
What did the cat do?
2. Robert eats apples. Mildred eats oranges. So does Susan. They all like to eat together.
What does Susan do?
3. Floyd has to stay with his baby sister. He wants to play with his friend James. James flies kites. So does Floyd.
What does Floyd do?

2. Pro-Verb, so--be/have

a. short

1. We are having a party. Mary is coming. So is Anne.
Sometimes Anne tells stories.
What is Anne going to do?
2. Bill likes animals. Tom and Jerome are watching the
circus. So is Bill. Bill wants to see tigers. What
is Bill doing?
3. Some days my brother and sister stay out late. Today
Sister came home early. So did Brother. Maybe they
will play with me.
What did brother do?

C. PRO-ADVERB

1. Pro-Adverb

a. short

1. Bill stayed with his aunt. He got lonely there. Bill
stays home alone sometimes. He doesn't have any
brothers and sisters.
Where did Bill get lonely?
2. Many farms are in the country. Charles lives on a farm.
Lots of animals are there. Some animals lie in the
grass.
Where are there lots of animals?
3. My brother works in a steel mill. He plays football in
the park. Now he is in the house. He likes to be
there.
Where does he like to be?

D. PRO-CLAUSE

1. Pro-Clause, so

a. short

1. The car may stall. If so, we will walk home. No buses
run on this road. I hope we can get a ride.
Why would we walk home?

2. The girls are not happy. Ann may cry. If so, we will leave. It is getting dark.
Why would we leave?
3. The baby hurt himself playing in the grass. He is learning to walk. The baby may fall. If so, I'll be sad.
Why would I be sad?

2. Clause Demonstrative

a. short

1. The car stalled. That makes Mr. Jones angry. He is already late. Mr. Jones wants to buy a new car now.
What makes Mr. Jones angry?
2. The family next to us had four children. The family moved. That made us sad. We will have to find some new friends.
What makes us sad?
3. We are having a picnic in the park. My sister played with the baby. The baby cried. This means we will go home.
Why will we go home?

E. PRO-ADJECTIVES

1. Pro-(Adjective Phrase)

a. short

1. Barbara and Mary have long, black dresses. Gloria just got a short, yellow dress. Kathy wants one of that kind. She is going to a party on Saturday.
What kind of dress does Kathy want?
2. The team has good-looking pants for today's game. The football field is wet and muddy. Soon the pants will look that way too. They will have to be changed.
How will the pants look?
3. Next to the hall is a big open room. No one is in there now. The room is cold and dark. That kind of room scares me.
What kind of room scares me?

F. SEMANTIC SUBSTITUTES

1. Semantic Substitutes--Noun

a. short

1. The brown cow is small. That animal is young. We also have a white sheep. It eats the grass on the hill. Which animal is young?
2. I have some blue trucks. Those toys are made of plastic. Plastic toys are not as strong as wooden ones. I also have some cars. Which toys are made of plastic?
3. This street has a green store. It is next to the white store. The white store is closed. That place is a bakery. Which place is a bakery?

2. Semantic Substitute--Verb

a. short

1. John milked the cows. That work took all morning. He also cleaned the barn. He needs to feed the pigs their corn. What work took all morning?
2. My mother sews dresses. Those men build houses. That job takes a long time. I like to watch my mother and those men work. What job takes a long time?
3. The short stop threw the ball too far. The other team was ahead. Bill dropped the ball. We lost after that mistake. What mistake did we lose after?

3. Semantic Substitute--Clause

a. short

1. Everyone in the class drew a picture. Bill made one too. That work was the best in the school. James also draws well. Which work was the best in the school?

2. Richard had on a clown mask. Kevin giggled. That laugh gave away the secret. The boys were trying to fool their father, but he laughed too.
What laugh gave away the secret?

3. Mildred was playing the piano. She hit a bad note. The phone rang. This sound woke me up.
What sound woke me up?

4. Semantic Substitute--Adverb

a. short

1. The T.V. program starts after the ball game. That time is a bit late for some people. Last week we had a meeting before the game. More people came to that meeting.
What time is a bit late for some people?

2. John sat on the bench. James sat under the pine tree. That spot was good for fishing. The boys were outside all afternoon.
What spot was good for fishing.

3. We have a big back porch. There are many chairs on it. The dog sleeps on the top step. That place is very warm.
What place is very warm?

SOURCE: Experimental materials provided by the author, Alan Lesgold. Experiment published in the Journal of Educational Psychology, 1974, 66, 333-338.

Summary of Cohesion, and Coding Scheme

A. Type of cohesion

REFERENCE		Coding
		R
1. Pronominals		1
(1) singular, masculine	<i>he, him, his</i>	11
(2) singular, feminine	<i>she, her, hers</i>	12
(3) singular, neuter	<i>it, its</i>	13
(4) plural	<i>they, them, their, theirs</i>	14
1(1-4) functioning as:		
(a) non-possessive,	<i>he/him, she/her, it,</i>	
as Head	<i>they/them</i>	6
(b) possessive, as Head	<i>his, her, (its), theirs</i>	7
(c) possessive, as Deictic	<i>his, hers, its, their</i>	8
2. Demonstratives and definite article		2
(1) demonstrative, near	<i>this/these, here</i>	21
(2) demonstrative, far	<i>that/those, there, then</i>	22
(3) definite article	<i>the</i>	23
2(1-3) functioning as:		
(a) nominal, Deictic or Head	<i>this/these, that/those, the</i>	6
(b) place adverbial	<i>here, there</i>	7
(c) time adverbial	<i>then</i>	8
3. Comparatives (not complete lists)		3
(1) identity	<i>eg: same, identical</i>	31
(2) similarity	<i>eg: similar(ly), such</i>	32
(3) difference (i.e.: non-identity and dissimilarity)	<i>eg: different, other, else</i>	33
(4) comparison, quantity	<i>eg: more, less, as many; ordinals</i>	34
(5) comparison, quality	<i>eg: as+adjective; comparatives and superlatives</i>	35
3(1-5) functioning as:		
(a) Deictic	(1-3)	6
(b) Numerative	(4)	7
(c) Epithet	(5)	8
(d) Adjunct or Submodifier	(1-5)	9

Note: Not all combinations of (1-5) with (a-d) are possible; the usual functions are those indicated here in the last table.

			Coding
SUBSTITUTION			S
1. Nominal substitutes			1
(1) for noun Head	<i>one/ones</i>		11
(2) for nominal Complement	<i>the same</i>		12
(3) for Attribute	<i>so</i>		13
2. Verbal substitutes			2
(1) for verb	<i>do, be, have</i>		21
(2) for process	<i>do the same/likewise</i>		22
(3) for proposition	<i>do so, be so</i>		23
(4) verbal reference	<i>do it/that, be it/that</i>		24
3. Clausal substitutes			3
(1) positive	<i>so</i>		31
(2) negative	<i>not</i>		32
3(1-2) substitute clause functioning as:			
(a) reported			6
(b) conditional			7
(c) modalized			8
(d) other			9
ELLIPSIS			E
1. Nominal ellipsis			1
(1) Deictic as Head			11
i. specific Deictic			1
ii. non-specific Deictic			2
iii. Post-deictic			3
(2) Numerative as Head			12
i. ordinal			1
ii. cardinal			2
iii. indefinite			3
(3) Epithet as Head			13
i. superlative			1
ii. comparative			2
iii. others			3
2. Verbal ellipsis			2
(1) lexical ellipsis ('from right')			21
i. total (all items omitted except first operator)			1
ii. partial (lexical verb only omitted)			2
(2) operator ellipsis ('from left')			22
i. total (all items omitted except lexical verb)			1
ii. partial (first operator only omitted)			2

Note: Where the presupposed verbal group is simple there is no distinction between total and partial ellipsis; such instances are

treated as 'total'. Where it is above a certain complexity there are other possibilities intermediate between the total and partial as defined here; such instances are treated as 'partial'.

3. Clausal ellipsis	3
(1) propositional ellipsis	31
i. total (all Propositional element omitted)	1
ii. partial (some Complement or Adjunct present)	2
(2) modal ellipsis	32
i. total (all Modal element omitted)	1
ii. partial (Subject present) [rare]	2
Note: Lexical ellipsis implies propositional ellipsis, and operator ellipsis implies modal ellipsis, unless all clause elements other than the Predicator (verbal group) are explicitly repudiated.	
(3) general ellipsis of the clause (all elements but one omitted)	33
i. WH- (only WH- element present)	1
ii. yes/no (only item expressing polarity present)	2
iii. other (other single clause element present)	3
(4) zero (entire clause omitted)	34
3(1-4) elliptical clause functioning as:	
(a) yes/no question or answer	6
(b) WH- question or answer	7
(c) 'reported' element	8
(d) otherwise	9

Note: Not all combinations of (1-4) with (a-d) are possible.

CONJUNCTION (items quoted are examples, not complete lists) C

Note: (E) = external, (I) = internal.

i. Additive		1
(1) simple: (E/I)		11
i. additive	<i>and, and also</i>	1
ii. negative	<i>nor, and...not</i>	2
iii. alternative	<i>or, or else</i>	3
(2) complex, emphatic: (I)		12
i. additive	<i>furthermore, add to that</i>	1
ii. alternative	<i>alternatively</i>	2
(3) complex, de-emphatic: (I)	<i>by the way, incidentally</i>	13
(4) apposition: (I)		14
i. expository	<i>that is, in other words</i>	1
ii. exemplificatory	<i>eg, thus</i>	2
(5) comparison: (I)		15
i. similar	<i>likewise, in the same way</i>	1
ii. dissimilar	<i>on the other hand, by contrast</i>	2

		Coding
2. Adversative		2
(1) adversative 'proper': (E/I)		21
i. simple	<i>yet, though, only</i>	1
ii. + 'and'	<i>but</i>	2
iii. emphatic	<i>however, even so, all the same</i>	3
(2) contrastive (avowal): (I)	<i>in (point of) fact, actually</i>	22
(3) contrastive: (E)		23
i. simple	<i>but, and</i>	1
ii. emphatic	<i>however, conversely, on the other hand</i>	2
(4) correction: (I)		24
i. of meaning	<i>instead, on the contrary, rather</i>	1
ii. of wording	<i>at least, I mean, or rather</i>	2
(5) dismissal: (I)		25
i. closed	<i>in any/either case</i>	1
ii. open-ended	<i>in any case, anyhow</i>	2
3. Causal		3
(1) general: (E/I)		31
i. simple	<i>so, then, therefore</i>	1
ii. emphatic	<i>consequently</i>	2
(2) specific: (E/I)		32
i. reason	<i>on account of this</i>	1
ii. result	<i>in consequence</i>	2
iii. purpose	<i>with this in mind</i>	3
(3) reversed causal: (I)	<i>for, because</i>	33
(4) causal, specific: (I)		34
i. reason	<i>it follows</i>	1
ii. result	<i>arising out of this</i>	2
iii. purpose	<i>to this end</i>	3
(5) conditional: (E/I)		35
i. simple	<i>then</i>	1
ii. emphatic	<i>in that case, in such an event</i>	2
iii. generalized	<i>under the circumstances</i>	3
iv. reversed polarity	<i>otherwise, under other circumstances</i>	4
(6) respective: (I)		36
i. direct	<i>in this respect, here</i>	1
ii. reversed polarity	<i>otherwise, apart from this, in other respects</i>	2
4. Temporal		4
(1) simple: (E)		41
i. sequential	<i>then, next</i>	1
ii. simultaneous	<i>just then</i>	2
iii. preceding	<i>before that, hitherto</i>	3

(2) conclusive: (E)	<i>in the end</i>	42
(3) correlatives: (E)		43
i. sequential	<i>first...then</i>	1
ii. conclusive	<i>at first/originally/ formerly...finally/now</i>	2
(4) complex: (E)		44
i. immediate	<i>at once</i>	1
ii. interrupted	<i>soon</i>	2
iii. repetitive	<i>next time</i>	3
iv. specific	<i>next day</i>	4
v. durative	<i>meanwhile</i>	5
vi. terminal	<i>until then</i>	6
vii. punctiliar	<i>at this moment</i>	7
(5) internal temporal: (I)		45
i. sequential	<i>then, next</i>	1
ii. conclusive	<i>finally, in conclusion</i>	2
(6) correlatives: (I)		46
i. sequential	<i>first...next</i>	1
ii. conclusive	<i>in the first place...to conclude with</i>	2
(7) here and now: (I)		47
i. past	<i>up to now</i>	1
ii. present	<i>at this point</i>	2
iii. future	<i>from now on</i>	3
(8) summary: (I)		48
i. summarizing	<i>to sum up</i>	1
ii. resumptive	<i>to resume</i>	2
5. Other ('continuative')	<i>now, of course, well, anyway, surely, after all</i>	5
6. Intonation		6
(1) tone		61
(2) tonicity		62

LEXICAL

1. Same item	L	1
2. Synonym or near synonym (incl hyponym)		2
3. Superordinate		3
4. 'General' item		4
5. Collocation		5
1-5 having reference that is:		

	Coding
(a) identical	6
(b) inclusive	7
(c) exclusive	8
(d) unrelated	9

SOURCE: Cohesion in English by M.A.K. Halliday and R. Hasan.
(1976, pp. 333-338)